Recent updates in the role of diffusion weighted MRI in diagnosis of cervical cancer

Thesis

Submitted for Partial Fulfillment of Master Degree
in Radiodiagnosis

By

Safa Kadhim Mahdi
M.B.,B.Ch

Supervised by

Prof. Dr. Ayman Mohamed Ibrahim
Assistant Professor of Radiodiagnosis
Faculty of Medicine - Ain Shams University

Dr. Amir Leuis Louka
Lecturer of Radiodiagnosis
Faculty of Medicine - Ain Shams University

Faculty of Medicine
Ain Shams University
2017

Abstract

Introduction: Cervical cancer is the third most common malignancy in women worldwide, and it remains a leading cause of cancer-related death for women in developing countries. In the United States, the cause related death from cervical cancer is relatively uncommon.

In Egypt, cervical cancer ranks as the second most frequent cancer after breast cancer, among women between 15 and 44 years of age.

Aim of Work: To evaluate the role of diffusion weighted MRI in the diagnosis of cervical carcinoma, with pathological diagnosis was taken as the reference.

Mythology: The study group consists of 30 patients in whom cervical cancer has been suspected clinically or by transvaginal u/s and confirmed by biopsy and control group consists of 30 patients in whom cervical cancer had been not suspected and MRI was performed because of other pelvic diseases.

Results: By (DCE-MRI), 29cases were diagnosed as malignant cervical lesions &1 case was diagnosed as benign lesion, The (DWI-MRI) also had the same results while by pathological examination revealed 28 cases were diagnosed as malignant cervical lesions &2 cases was diagnosed as benign lesion.

Conclusion: Because of time restrictions, radiologists have to make a choice between different sequences. Our results proved that (DW–MRI*)* was significantly beneficial in terms of diagnostic performance. For patients who cannot receive contrast medium, dynamic contrast-enhanced imaging can be replaced by DWI. Thus, we suggest that DWI should be included in the routine pelvic MRI protocol.

Recommendations: Further study with larger number of patients is recommended.

Keywords: Recent updates, Diffusion Weighted, MRI, Cervical Cancer

بسم الله الرحمن الرحيم

قالوا

سبحانك لا علم لنا

إلا ما علمتنا إنك أنت

العليم الحكيم

صدق الله العظيم

سورة البقرة الآية: ٣٢

ACKNOWLEDGEMENT

First of all, thanks to Allah whose magnificent help was the main factor in completing this work.

No words can express my deep sincere feelings Towards Prof. Dr. Ayman Mohamed Ibrahim, Assistant Professor of Radiodiagnosis, Faculty of Medicine-Ain Shams University for his continuous encouragement, guidance and support he gave me throughout the whole work. It has been a great honor for me to work under his generous supervision.

I would like to express my deepest appreciation, respect and thanks to Dr. Amir Leuis Louka, Lecturer of Radiodiagnosis, Faculty of Medicine-Ain Shams University, for his continuous guide in all aspects of life beside his great science, knowledge and information.

Last but not least, sincere gratitude to *My Family* for their continuous encouragement and spiritual support.

Contents

List of Abbreviations

ADC	: Apparent diffusion coefficient
CIN	: Cervical intraepithelial neoplasia
CT	: Computed tomography
DCE	: Dynamic Contrast-Enhanced
DWI	: Diffusion-weighted imaging
FIGO	: Federation of gynecology and obstetrics
Gd	: Gadolinium
HPV	: Human papilloma virus
IUCD	: Intrauterine contraceptive device
MRI	: Magnetic Resonance Imaging
RF	: Radiofrequency
SC	: Squamocolumnar
SCC	: Squamous cell carcinoma
SNR	: Signal-to-noise ratio
T1WI	: T1-weighted images
T2WI	: T2-weighted images
TNM	: Tumor node metastasis

List of Figures

List of Tables

Introduction

Cervical cancer is the third most common malignancy in women worldwide, and it remains a leading cause of cancer-related death for women in developing countries. In the United States, the cause related death from cervical cancer is relatively uncommon ***(Benard et al, 2014 & Siegel et al 2015).***

In Egypt, cervical cancer ranks as the second most frequent cancer after breast cancer, among women between 15 and 44 years of age ***(Mona et al., 2013)***.

The cervical cancer diagnosis is suspected according to the symptoms, results of clinical examinations, positive screening cytology results and is confirmed by biopsy. It is important to assess the extent of the disease before planning surgical treatment or chemotherapy and radiation therapy ***(Moore et al., 2006)***.

Magnetic resonance imaging (MRI) complements the clinical examination and is the optimal imaging method for evaluating the spread of cervical cancer. It helps to select more accurately the most appropriate treatment approach; an operation, radiation therapy or chemotherapy-for each patient. MRI images visualize the cervical tumor, its spread to adjacent tissues and organs and metastases in the lymphatic nodes more clearly ***(Balleyguier et al., 2011)***.

MR imaging represents the single most effective modality for detection of primary tumor and local spread. In revealing nodal involvement, CT and MR imaging are equally effective.MR imaging is also the best modality for showing recurrent disease and monitoring therapeutic response ***(Ayshea et al., 2015)***.

The most important prognostic factors for cervical cancer are tumor stage and size. Although not included in the international federation of gynecology and obstetrics (FIGO) staging, the presence and extent of nodal involvement is another important prognostic factor ***(Chen et al., 2016).***

The most important issue in staging of cervical cancer is to distinguish early disease(stage 1 and 11A) that can be treated with surgery from advance disease(stage 11B or greater) that must be treated with radiation alone or combine with chemotherapy ***(Pecorelli et al., 2009).***

MRI is the best single imaging investigation that can accurately determine tumor location (exophytic or endocervical), tumor size, depth of stromal invasion, and extension into the lower uterine segment ***(Okamoto et al., 2003)***.

Diffusion-weighted imaging (DWI) is one of the evolving imaging technologies. It carries the potential to improve tissue characterization when findings are interpreted together with conventional MR imaging sequences ***(Kido et al., 2013 & William et al., 2014)***.

The principle of this examination is based on the diversity of the movement of water molecules in a biological tissue and is characterized by an apparent diffusion coefficient (ADC) ***(Padhani et al., 2010)***. ADC value provides useful information about the effectiveness of the therapy as well as differentiation between malignant tumor tissue and normal tissue ***(Naganawa et al., 2005)***.

Malignant cervical tissue demonstrates restricted diffusion and hence reduced ADC values when compared to normal tissue. DWI & ADC maps allow differentiation of benign from malignant zones of cervix with high sensitivity and specificity ***(Payne et al., 2010 & Chen et al., 2011).***